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SHEET METAL CABLE HOOK

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3           The present application is related to provisional patent application serial  
4       number 60/363,250 entitled "Sheet Metal Cable Hook" filed on March 12, 2002,  
5       priority from which is hereby claimed.

6 FIELD OF THE INVENTION

7           The present invention relates to self-clinching fastener that provides a  
8       permanent location for removably attaching items such as a wiring or fiber-optic  
9       bundle.

10 BACKGROUND OF THE INVENTION

11           Electrical equipment quite often has the signal and/or power distribution  
12       wiring-bundle routed around the inside of a metal cabinet. It is important that this  
13       wiring-bundle be secured in a specific location inside the cabinet to ensure that  
14       mechanical and electrical interference concerns are properly addressed. It is further  
15       desirable to have the outside of the cabinet flush and sealed for environmental and  
16       electrical interference reasons. It is yet further desirable that the wiring-bundle can be  
17       temporarily relocated with minimal risk of damage.

18           The known attachment methods do not adequately address these requirements  
19       and have several shortcomings. One known attachment method is to mount an  
20       adhesive based element to a flat surface and then use this mount to secure the wiring-  
21       bundle with a permanent plastic cable-tie. However, the adhesive mount is subject to  
22       failure and high temperatures or temperature variations can cause adhesive bond to

1 deteriorate and release. Furthermore, this attachment method does not allow for easy  
2 removal of the wiring-bundle for maintenance. Another known attachment means for  
3 mounting cables includes snapping a plastic mount through a hole in the exterior of the  
4 panel, however because this type of plastic mount protrudes through the outside of the  
5 panel it is not flush. Threaded fastening devices have been employed to mount cables,  
6 however they must be inserted from the outside of the cabinet and then through the  
7 mounting device on the inside which is often awkward and may require two people to  
8 perform. In yet another attachment method, prior art clinch fasteners have been used  
9 to provide the required smooth metallic outer surface for the cabinet, however they  
10 only provide a walled hole on the inside through which the wiring-bundle cable-tie  
11 must be passed. This permanently attaches the wiring-bundle and if the wiring-bundle  
12 needs to be temporarily repositioned the cable-tie needs to be cut, posing risk of  
13 damage to the wiring-bundle during the cutting operation and further requiring a new  
14 cable-tie for reassembly.

15 It is therefore an object of the present invention to provide a permanently  
16 mounted fastener that establishes a fixed location for securing a wiring-bundle while  
17 allowing for its easy removal and repositioning. It is yet another object of the present  
18 invention to provide an attachment mounting for a wire-bundle cable-tie which permits  
19 the cable-tie to be easily removed. It is another object of the present invention to  
20 provide a hook-type wire-bundle holder which prevents the inadvertent removal of the  
21 cable-tie. It is a further object of the invention to provide a panel-mounted fastener  
22 that can releaseably secure a variety of different items such as springs, rods, tubing, or

1 shafts. It is yet a further object of the invention to provide a hook-type mounting  
2 which provides abrasion resistance and electrical insulation.

3 **SUMMARY OF THE INVENTION**

4 The present invention is a metal fastener which is permanently clinched into a  
5 rectangular hole in a metallic panel such as the wall of a metal cabinet. The clinching  
6 process ensures a flush, permanent, sealed metallic outer surface which can be  
7 cosmetically finished with the same process, such as painting, used to finish the rest of  
8 the cabinet. A portion of the fastener protruding on the inner surface of the cabinet  
9 includes a hook of specific shape and size. The lateral opening of the hook allows an  
10 industry standard screw-mount cable-tie to be placed through the opening from the  
11 side.

12 More specifically, the applicant has invented a cable hook having a self-  
13 clinching attachment means which includes a substantially rectangular base having a  
14 planar bottom surface and further including panel attachment means located on  
15 opposing front and rear side surfaces thereof. A hook portion extends upwardly from  
16 the base, the hook portion including upper and lower jaws forming a substantially C-  
17 shaped hook with a frontal opening located between spaced ends of the jaws. The C-  
18 shaped hook has a lateral opening that is substantially circular. The cable hook further  
19 includes a single laterally extending notch on the inside surface of the upper jaw  
20 proximate the frontal opening. The jaws have a continuous arcuate inside surface  
21 except for the notch. The base includes orientation marks on the bottom planar  
22 surface thereof proximate only one of the front or rear sides. The panel attachment

1 means are deformable undercut grooves for receiving the cold flow of metal from a  
2 panel attached thereby.

3 In alternate embodiments, a metal or electrically non-conductive thermoplastic  
4 insert encompasses the inside surface of the jaws and partially encompasses the lateral  
5 sides of the fastener adjacent the lateral opening, covering the edges of the jaws. A  
6 pivotable flap lies across the frontal opening to positively retain items held within the  
7 hook. The flap is unitary with the insert and resiliently biased toward a closed  
8 position.

9 In another embodiment, a spring-biased catch covers the frontal opening of the  
10 fastener to positively retain items held within the hook. The insert has two opposing  
11 ears which have inward-facing dimples that engage cooperating recesses on opposite  
12 sides of the lower jaw to provide a pivot for the catch. A tail portion of the insert is  
13 free to slide against the inside surface of the lower jaw to provide a spring force to  
14 close the catch.

15 When using the invention, the cable-tie is placed around the wiring-bundle and  
16 secured in the normal manner. If the wiring-bundle must be temporarily relocated, the  
17 cable-tie can be removed from the front of the fastener through a gap between the  
18 jaws of the hook without unbundling the wires. Re-attachment of the wiring-bundle is  
19 readily accomplished by reversing the process from the front end of the hook. No new  
20 cable-ties are required and the risk of damaging the wiring-bundle during a  
21 removal/cutting operation is eliminated. The fastener shape and opening size retain  
22 the cable-tie in many positions yet allow for its easy removal. Other objects and

1 advantages of the present invention will be readily apparent to those of skill in the art  
2 from the following drawings and description of the preferred embodiments.

3 **BRIEF DESCRIPTION OF THE DRAWINGS**

4 Figure 1 is an isometric view of the sheet metal cable hook of the present  
5 invention.

6 Figure 2 is a side view of the invention installed in a metal sheet which is  
7 shown in phantom lines.

8 Figure 3 is an isometric view of the sheet metal cable hook mounted on a  
9 vertical panel shown in phantom lines with the cable-tie and wiring-bundle.

10 Figure 4 is a left side isometric view of an alternate embodiment including a  
11 plastic insert.

12 Figure 5 is a left side isometric view showing an alternate embodiment which  
13 utilizes a grommet-type insert.

14 Figure 6 is a left side isometric view of an alternate embodiment which includes  
15 a catch covering the opening of the hook portion of the fastener.

16 Figure 7 is a left side view of a second alternate embodiment incorporating a  
17 spring-biased hook covering the opening of the fastener.

18 **DESCRIPTION OF THE PREFERRED EMBODIMENTS**

19 Referring to Figure 1, the present invention 10 is a metal, self-clinching  
20 fastener. A base 17 is substantially rectangular and flat, and includes clinch features,  
21 deformers 18 and undercut 16 which are provided at opposite sides. An upper portion  
22 of the fastener includes two curved jaws 21 and 23 which form a "C"-shaped hook

1 having a lateral opening 15 that is substantially circular. Upper jaw 21 is an arcuate  
2 hook extending from the lower portion or base 17 of the fastener which includes lower  
3 jaw 23. The upper portion, or hook, of the fastener including curved jaws 21 and 23 is  
4 of uniform, lateral thickness. A frontal opening 22 between the ends of the jaws may  
5 be sized to closely receive a cable-tie or similar structure of rectangular cross-section,  
6 sideways. The hook formed by jaws 21 and 23 has a continuous arcuate inside surface  
7 except for notch 20. Notch 20 helps to prevent unintentional removal of the cable-tie  
8 due to vibration. Orientation marks 12 on the bottom of the base 17 allow for easy  
9 identification of the cable-tie receiving end of the fastener when it is being installed  
10 from the opposite side of the attached metal sheet if the hook portion is not visible to  
11 the installer.

12 Figure 2 shows the fastener 10 installed in a metal sheet 19. Fastener 10 is  
13 pressed into a rectangular opening in metal sheet 19 until the flat base 17 is flush with  
14 the insertion side of the sheet. When fully installed, the deformor 18 displaces a  
15 portion of the metal sheet 19 into the undercut 16 thereby embedding the clinch  
16 features and locking the fastener 10 into the sheet. The hook portion includes a lateral  
17 opening 15 and a frontal opening or mouth 22 between the jaws at the front of the  
18 fastener. Notch 20 is included on the inside of the upper jaw 21 near its end.  
19 Orientation marks 12 are positioned toward the front end of the fastener and are  
20 visible from the opposite side of the sheet to ensure that the fastener is properly  
21 oriented when installed.

22 Figure 3 shows fastener 10 in the position installed on a vertical wall in a

1 cabinet or similar enclosure 19 with the hook opening 22 in an upward-facing position.  
2 As depicted, the cable-tie 30 has been fitted over the jaw 21 and is hanging from the  
3 fastener and wrapped around the wiring-bundle 40 in the normal manner. The cable-  
4 tie 30 shown is an industry standard version that is normally screw-mounted by a  
5 through-hole 32 in portion 31. The hook of the fastener is carefully sized so that the  
6 thickness of the screw-mounting portion 31 is greater than the dimension of opening  
7 22. Therefore, the cable-tie through-hole must be rotated at an angle over jaw 21 of  
8 the fastener to achieve attachment. This careful sizing of the hook opening and cable-  
9 tie thickness ensures that the cable-tie will not readily separate from the fastener  
10 during normal use because a compound motion is required to remove it from between  
11 the jaws of the hook. Once received, the structure is permitted some degree of  
12 movement within the hook opening but it is not easily removed between the jaws.

13 The embodiment shown in Figures 1-3 typifies the simplest version of the  
14 present invention which, as it will be understood by those of skill in art, may be used  
15 for many different applications and oriented in different ways. For example, the  
16 fastener may be applied to either horizontal or vertical surfaces. In the case of  
17 attachment to a vertical surface, the opening of the hook may face downward while  
18 still retaining the cable-tie. Furthermore, it may be used to attach many other items  
19 such as a spring, a rod, tubing, or a shaft. The uses of the invention are limited only by  
20 the imagination of one employing the device.

21 Figures 4-7 depict alternate embodiments of the invention. Figure 4 shows an  
22 isometric and side view of fastener 10 with an added plastic insert 40 encompassing

1 the inside surface of the jaws. The plastic insert wraps around the lateral sides of the  
2 fastener adjacent opening 15 to provide abrasion resistance and electrical insulation  
3 between an item that is inserted through the opening and the fastener jaws while the  
4 opening 22 remains unobstructed.

5 Figure 5 shows an isometric and side view of fastener 10 with a thermoplastic  
6 insert or grommet 50 covering the fastener opening and the edges of the jaws around  
7 it. The grommet 50 is tubular and closes opening 22.

8 Figure 6 shows fastener 10 further including a flexible plastic insert 60. Flap  
9 61 of plastic insert 60 covers the frontal opening 22 of fastener 10 and pivots at point  
10 63 while biased to contact the upper jaw 21 at point 65 due to its shape memory.  
11 Feature 64 of the plastic insert serves two functions, it provides a stop for the motion  
12 of flap 61 in the closing direction and it also keeps the plastic insert from rotating  
13 around lateral opening 15. The plastic insert 60 also serves to cover the metal surfaces  
14 around the lateral opening 15 for abrasion resistance and electrical insulation. In this  
15 way, a clip is formed to positively retain an item such as a cable-tie loop which passes  
16 through the lateral hook opening. Items retained by the hook may be released by  
17 depressing the flap in the usual way.

18 Figure 7 shows a side view of fastener 10 including a formed metal insert 70.  
19 The insert provides a spring-biased catch 72 covering the opening 22 at the front of  
20 the fastener so that the hook portion, as in the previous embodiment, forms a spring  
21 clip and items inserted through the opening of the hook may not be removed from the  
22 front without assistance. The insert 70 is pivoted at point 73 and is biased against the

1 upper jaw 21 at point 74. The metal insert includes two opposing ears 76 which have  
2 inward-facing dimples that cooperate with like dimensioned recesses on opposite sides  
3 of the lower jaw 23 to achieve the pivot point 73. This combination of mechanical  
4 structures holds the insert laterally and provides a snap-fit attachment of the insert to  
5 the hook. The closing force is provided by spring portion 71 that includes a tail 75  
6 which is free to slide against the inside surface of the lower jaw 23. Items which pass  
7 through the hook opening may only be removed from the opening of the hook after  
8 the catch has been depressed as required in the usual clip attachment/release fashion.  
9 The insert 70 may also be formed of plastic.

10 It should be understood that there may be other modifications and changes to  
11 the present invention that will be obvious to those of skill in the art from the foregoing  
12 description, however, the present invention should be limited only by the following  
13 claims and their legal equivalents.